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POSITION STATEMENT

Work environment risks for health care workers with cystic fibrosis

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ABSTRACT

In Australia and New Zealand, >50% of people with cystic fibrosis (CF) are adults and many of these people are pursuing vocational training and undertaking paid employment. More than 6% of adults with CF are working in health care. There is limited guidance in literature to support health care workers with CF (HCWcf) in training and in employment to support safe practice and to provide protection for themselves and their patients from the acquisition of health care associated infection. A multidisciplinary team of CF and Infectious Disease Clinicians, Infection Prevention and Control Practitioners, HCWcf, academic experts in medical ethics and representatives from universities, appraised the available evidence on the risk posed to and by HCWcf. Specific recommendations were made for HCWcf, CF health care teams, hospitals and universities to support the safe practice and appropriate support for HCWcf.

Key words: cystic fibrosis, health care workers, infection, transmission.

INTRODUCTION

Cystic fibrosis (CF) affects ~3250 people in Australia and ~450 in New Zealand.[1,2] Improvements in survival have meant that >50% of the population are now adults. Despite dramatic improvements in survival, suppurative lung disease and associated chronic bacterial infection remain the major cause of morbidity and mortality.[3,4] Airway pathogens in people with CF, including *Pseudomonas aeruginosa*, methicillin-resistant *Staphylococcus aureus* (MRSA), *Burkholderia cepacia* complex, *Stenotrophomonas maltophilia*, *Achromobacter xyloxidans* and non-tuberculous mycobacteria (NTM), increase in prevalence with increasing age.[1,2,5–8] Up to 80% of adults have chronic *P. aeruginosa* infection.[2,8]

The number of adults with CF studying and pursuing vocations is also increasing. In Australia, more than two-thirds of adults are undertaking paid employment.[2] A UK study reported that 6.6% of the British adult CF population were working in health care.[9] Similar proportions are seen in two large adult Australian CF centres (7%, respectively,[10] Peter G. Middleton, unpublished data with permission). Health care workers (HCW) with CF (HCWcf) may be at risk from acquiring respiratory infection whilst undertaking their role in the workplace,[11] and may also have chronic respiratory infection, which could pose a risk to others in the work place including other people with CF, other staff (with other health conditions) and patients (non-CF).[1,2]

Infection Control Guidelines for the management of people with CF (in general) are available.[12] The Infection Prevention and Control Guidelines for Cystic Fibrosis: 2013 Update provides an extensive review of the literature and recommendations of all aspects of infection control for

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people with CF in North America.[13] Guidelines for HCW with health conditions have been published by Committee of Deans of Australian Medical Schools on behalf of Australian Universities, National Health and Medical Research Council (NHMRC), Australian Medical Association (AMA) and other professional bodies.[14] These guidelines do not address the specific challenges for HCWcf or persons with other suppurative lung diseases working in health care.

The purpose of this position paper is to evaluate the evidence for decision-making for the HCWcf, including those in training, and provide a structure for informed decision-making, which considers the personal rights of the HCWcf in training or working in a health care facility and patients and the needs of the educational institution and health service. It is anticipated this position paper will be used by HCWcf, CF health care teams, hospital and health services, infection prevention and infection control teams, universities and specialty training organizations in Australia and New Zealand, and are likely to be applicable to people with CF internationally. A significant stimulus to the development of this position paper was the anecdotal cases of adverse outcomes in people with CF, occurring during training.

The working group is made up of members with expertise in CF care, infectious diseases and infection prevention and control, medical ethics and includes a HCWcf and one in training. Three subgroups evaluated the available evidence and contributed sections of the document according to their expertise which were approved by the whole group after several rounds of teleconference discussions. Co-chairs wrote an initial draft which was discussed and edited until consensus was reached by all members of the working group. No HCWcf on the working group was employed by the hospitals of clinicians involved in the preparation of this document. One HCWcf received personal CF health care in a CF centre where two of the clinicians were employed.

The document has been reviewed and endorsed by a number of organizations including: TSANZ; Australasian Society of Infectious Diseases; Australian College of Infection Prevention and Control; representatives of the University of Auckland; Auckland and Monash University, Melbourne; Cystic Fibrosis Australia; Cystic Fibrosis New Zealand; and the Australian CF Centre Directors Forum. This position paper will be revised and updated by December 2022.

Studies to date have demonstrated infrequent sharing of strains of bacteria amongst patients with bronchiectasis, attending specialist respiratory and bronchiectasis clinics. As there are limited data on the risks of infection acquisition and transmission in the health care setting for people with other forms of suppurative lung diseases (e.g. bronchiectasis), these recommendations could also apply to HCW with other forms of suppurative lung diseases (e.g. bronchiectasis), as the general principles are likely to be similar.

HCW ROLES AND RISKS OF INFECTION ACQUISITION

The magnitude and direction of risk of infection to a HCW may be influenced by the role of the HCW in the workplace, and the types of patients with whom the HCW interacts. In general, the risk of contact or inhalation of pathogenic organisms will relate to the number of organisms within the environment. HCWcf may be exposed to pathogenic organisms by contact (direct and indirect), droplet or airborne modes of transmission.

It is appropriate that HCWcf who have no patient contact are managed within the workplace according to the general infection control principles for HCW.

INFECTION-SPECIFIC RISKS TO THE HCWCF FROM THE WORKPLACE

Although there is no published evidence for adverse clinical outcomes in the HCWcf, there are risks that need to be considered. There are numerous reports of HCW contracting infections while at work. The risks of hepatitis B, hepatitis C, HIV and *Mycobacterium tuberculosis* are well documented and will not be discussed further here, as such risks are universal to all HCW.[15]

Influenza and other respiratory viruses

The known risks of transmission of influenza to HCW in general, can impact on the HCWcf in the workplace. Other respiratory viruses (e.g. rhinovirus and parainfluenza) may also be spread in the workplace and can impact on the health of HCWcf.

Bacterial Infections

Certain respiratory bacteria present a specific risk to the HCWcf and include:

1. *Burkholderia cepacia* complex—Patient-to-patient transmission of *B. cepacia* complex has been documented in both the community and health care settings.[16–20] Transmission from patient-to-HCWcf and HCWcf-to-patient has not been documented. There is also a case of presumed transmission from a child with CF to the mother (without CF).[21]
2. *Staphylococcus aureus*—A case report has documented a HCWcf contracting an endemic strain of MRSA from a patient.[22] One study has shown that HCWcf have an eightfold increased risk of acquisition of MRSA compared to their non-HCW peers with CF. It has been hypothesized by the authors that this may have been as a consequence of their work as health care professionals rather than when the HCWcf was receiving health care.[10]
3. *Pseudomonas aeruginosa*—The frequency of 'shared' strains of *Pseudomonas* in CF clinics has suggested that patient-to-patient transmission of *P. aeruginosa* is very likely to have occurred between patients with CF.[23–32]
4. *Clostridium difficile* infection—Patients with CF may be at an increased risk of *Clostridium difficile* infection (CDI) due to greater exposure to antibiotics.[33,34]

Mycobacterial infections

From the limited evidence available, *Mycobacterium abscessus* may pose a cross infection risk within CF centres. Two reports have suggested that person-to-person spread of strains of *M. abscessus* may have occurred and were linked to patients receiving care at

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specific CF centres for clinical care in the USA and UK.[35,36] A recent international study documented several related clones of *M. abscessus* complex across UK, Europe, USA and Queensland locations.[37] Not all reports have found clonality amongst strains causing *M. abscessus* infection in CF cohorts.[38]

RISK OF THE SPREAD OF ORGANISMS FROM HCWCF TO OTHERS IN THE HEALTH CARE SETTING

HCWcf may be chronically infected with bacterial, mycobacterial and fungal pathogens, which could pose a risk to others in the workplace, including patients (with or without CF or other lung disease) and staff (with or without lung disease). There are no studies that have evaluated the risk of pathogen transmission by HCWcf to patients or co-workers. Transmission pathways of these organisms are likely to be lessened by following standard and transmission-based precautions (Appendix S1, Supplementary Information).

There are no documented cases in the literature of HCWcf transmitting an organism to a patient in their care. It is important that policies regarding HCWcf both ensure the health and safety of patients and the HCWcf and preserve the ability of the HCWcf to undertake patient care.

Transmission may occur by three modes:

1. Contact—direct or indirect contact where an inanimate surface or object is contaminated;
2. Droplet—the transmission of respiratory droplets carrying infective pathogens to susceptible mucosal surfaces over short distances, for example <2 m when an infected person coughs, sneezes or talks or during procedures such as suctioning and endotracheal intubation;
3. Airborne—the transmission of infectious agents within the respirable size range via droplet nuclei.[11,13,39–41]

Contact routes

There is evidence that patients with CF who are infected with MRSA, *P. aeruginosa* and *B. cepacia* complex may cause hand contamination.[42] Similarly, inanimate objects can be contaminated by genetically identical bacteria when in close proximity to patients with CF,[43] suggesting that CF pathogens may be transmitted by contact.

Thus, HCWcf who are colonized with MRSA may transmit the organism by contact in the same manner as non-CF HCW. About 4.6% of the Australian CF population are colonized with MRSA.[44] The prevalence of MRSA colonization amongst Australian HCW is unknown but in one Western Australian study of 1542 HCW, 3.4% (range 0.7–6.8% by occupational group) were colonized with MRSA.[45]

Droplets and/or airborne routes

Most research studying the role of droplet and/or aerosol transmission of CF pathogens has been based on *P. aeruginosa* and includes:

1. Probable person-to-person transmission,[25] that is supported by reduced incidence and prevalence of shared strains with the implementation of strict cohort segregation.[26]
2. Some evidence of adverse clinical outcome in CF patients infected with shared *P. aeruginosa* strains.[23,30,46,47]
3. Potential for droplet and aerosol transmission of *P. aeruginosa* following respiratory manoeuvres (e.g. following nebulization and performing physiotherapy and spirometry).[48–50]
4. High rates of air contamination observed during outpatient spirometry manoeuvres.[51]
5. Simulation experiments of coughing have demonstrated droplet nuclei aerosols of *P. aeruginosa*.[52,53]
6. CF patients with coughing contaminate sterile sheets 1 m from source.[54]
7. Good hand hygiene practices reduced hand contamination in patients, following CF clinic visits.[43]
8. Cough aerosol contamination with *P. aeruginosa* and other common CF pathogens in droplet nuclei in the respirable size range (<5 μm).[55,56] During coughing, droplet nuclei can travel long distances (up to 4 m) and remain airborne for prolonged durations (up to 45 min).[57]
9. Masks worn during cough procedures by patients with CF reduce room air contamination with *P. aeruginosa* by 86%.[58]
10. Room contamination was low in patients wearing surgical masks and surgical masks reduced viable bacterial contamination via cough in patients with CF by ~90%.[51,58]
11. Potentially infectious bacterial aerosols generated during coughing were dramatically reduced (to 5% of the bacterial concentrations seen during unmasked cough) suggesting short-term benefit of mask wearing. Talking without a mask led to minimal bacterial contaminated aerosols.[59]
12. The role of droplet nuclei transmission of other pathogens is supported by limited evidence and is summarized below:
    a. Influenza and other respiratory viruses may be associated with pulmonary exacerbations of CF.[62] One large prospective cohort estimated an excess of 2.1% CF exacerbations during the influenza season[63] and isolation of respiratory viruses increased during exacerbations of CF.[64] In one case report, a patient with CF, on prednisolone, was reported to have shed influenza H1N1 virus for 4 months in the sputum.[65]
    b. In studies on healthy volunteers, influenza and respiratory syncytial virus are detectable in cough aerosol particles in the respirable range.[65–68]
    c. In unpublished data from Queensland, bacterial pathogens (in addition to *P. aeruginosa*) were detected in cough aerosols and were found to travel long distances (up to 4 m) and remain airborne for prolonged durations (up to 45 min) in chronic airway infection patients with non-CF bronchiectasis and COPD.[69]
13. Importantly, patients with bronchiectasis attending specialist bronchiectasis clinics where patients with

CF also receive care, have been shown to be infrequently infected with shared strains of bacterial infection (e.g. *P. aeruginosa*).[60,61]

GENERAL INFECTION CONTROL PRINCIPLES

It is important that HCWcf engage with their clinical workforce health care team and/or local infection prevention and control teams and that HCWcf observe current health care facility policies and guidelines for the workplace.[15]

A health care task that involves the generation of respiratory droplets or droplet nuclei by a patient may lead to transmission from the patient to the HCWcf by droplet and/or airborne routes. Other tasks of health care may involve direct and indirect contact routes of transmission of infection.

Some recommendations in the recent Infection Control for CF Guidelines (USA)[13] have not been adopted in all centres in Australia and New Zealand, in particular, the use of surgical masks for all health care contact when caring for persons with CF. This recommendation may be challenging for HCWcf undertaking their role as health care professionals.

The evidence to support mask wear is limited and recently editorialised by Simmonds and Bush.[70] However, the majority of CF centres in Australia and New Zealand have implemented or are actively considering implementing similar policies for the care of their patients with CF. Recent data from Queensland have confirmed that talking is a low-risk activity in terms of generating potential infectious aerosols.[59] However, it is important that wearing surgical mask be considered when HCWcf working in a clinical setting are unable to control their cough.

GENERAL LEGAL PRINCIPLES

Discrimination against a prospective or current employee suffering from an illness or injury is generally unlawful. An employer is required to make 'workplace adjustments' that enable the person with an illness or injury to perform his/her work as long as these are reasonable and do not cause unjustifiable hardship to the employer. A prospective employee is not required to disclose preexisting medical conditions and/or injuries during the recruitment process. However, if the illness or injury could reasonably be expected to affect the employee's ability to carry out the duties required, and the employee has not disclosed, they may be unable to claim worker's compensation for work-related harms.

A person who believes they have been discriminated against on the basis of their health status may make a formal complaint to the relevant human rights body, in accordance with the laws that apply in their jurisdiction. In addition, though rarely applied to the transmission of disease, intentionally or recklessly harming another may be considered a criminal act.

KEY RECOMMENDATIONS FOR HCWCF

It is recommended:

1. That the HCWcf receive regular reviews in accordance with usual CF care by a specialist CF team, including the monitoring of clinical status and airway microbiology.[12] It is also important that eradication and decolonization of specific bacterial pathogens be considered and discussed with the specialist CF team, and where appropriate with an infectious diseases physician with professional links to the CF team.
2. That the HCWcf not provide health care to patients with CF.
3. That the HCWcf strictly adhere to recommended hand hygiene, cough etiquette and the wearing of personal protective equipment (PPE) as required for standard and transmission-based precautions.
4. That the provision of regular (at least annual) practical training/updates and competency assessments by the local infection prevention and infection control team be part of the work plan (see below).
5. That the HCWcf wear a mask and eye protection to protect susceptible mucosal surfaces (as required by standard precautions) when the health care task involves the generation, or possible generation, of respiratory droplets or droplet nuclei (e.g. chest physiotherapy, endotracheal or tracheostomy tube suctioning) in patients.
6. That the HCWcf who is able to avoid coughing and comply with standard precautions need not wear a mask during patient interactions or within patient ward bays or rooms. Talking is a 'low aerosol' generating activity.
7. That the HCWcf not attend work when suffering from an acute respiratory infection/exacerbation of CF lung disease and the return to work be discussed and cleared by the CF physician responsible for delivering CF care to the HCWcf.
8. That the HCWcf regularly perform airway clearance outside the health care setting (ideally at home, but if required in a designated non-patient care area) and that airway clearance be discussed and incorporated in the individual work plan negotiated between the HCWcf, their CF physician and the work unit supervisor (further research examining risks posed by and to the HCWcf working directly in the delivery of health care is required (Box 1)).

SPECIFIC RESPONSIBILITIES

Health care worker with CF

It is recommended:

1. That the HCWcf undergo regular training in infection prevention and control in order to minimize any risk of transmission to or from the hospital environment, inanimate objects/equipment, other HCW and patients.
2. That the HCWcf discuss with their CF team the risks involved in their specific health care role, and how to minimize these risks (whether at the same hospital or a different institution).

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Box 1: Evidence-Limited Areas of Concern Requiring Further Research

1 Prospective studies examining risks posed by and to the health care worker with CF (HCWcf) working directly in the delivery of health care.

2 Study of the risk of cough-associated infection for pathogens other than *P. aeruginosa* infection.

3 Study of the effectiveness of interventions including hand hygiene, cough etiquette and the use of surgical masks on risk for HCWcf, their patients and the broader health care physical environment.

4 Study of the impact of health status on career progress for the HCWcf.

5 Exploration of logistical patient care and organizational issues that HCWcf continue to face during training and employment.

Box 2: Tasks of Health Care

Tasks of health care that are a low transmission risk to the PATIENT if:

1 The health care worker with CF (HCWcf) strictly observes hand hygiene, cough etiquette and the wearing of personal protective equipment (PPE) as required.

2 The HCWcf has mild lung disease (infrequent cough and/or minimal sputum production).

3 The HCWcf with a chronic lower respiratory infection and a productive cough wears a surgical mask if coughing cannot be suppressed.

4 The HCWcf is performing tasks that do not involve the generation of HCWcf droplets or droplet nuclei.

5 The HCWcf is talking without coughing.

Tasks of health care that are associated with increased transmission risk for the PATIENT if:

1 The HCWcf does not perform hand hygiene, cough etiquette and the wearing of PPE as required.

2 The HCWcf has an acute respiratory viral infection.

3 The HCWcf has a frequent cough that cannot be suppressed and HCWcf is infected with *P. aeruginosa*, *B. cepacia* complex, methicillin-resistant *S. aureus* or *M. abscessus*.

3. That the HCWcf have regular testing for pathogenic organisms in sputum and discuss the results with their CF team.
4. As required for all staff, that the HCWcf use adequate PPE including wearing a surgical mask to protect themselves from acquisition of pathogenic organisms, and be up-to-date with all recommended immunisations (e.g. measles, mumps, rubella, pertussis, tetanus, diphtheria, polio and influenza) prior to commencing work and maintain this during their employment.
5. As required for all staff, that the HCWcf safely practice to reduce risks to their health and to that of their patients. An open and collaborative relationship with the CF team and infection prevention and control team can facilitate this.
6. That the HCWcf disclose significant changes in their infection status to their supervisor and the hospital infection prevention and control team.
7. That individual work planning for the HCWcf consider the following (see Box 2; Appendix S2, Supplementary Information):
   a. Scheduling annual, standard and transmission-based precautions, practical training/updates and competency assessment by the local hospital infection prevention and control team.
   b. Assigning a supervisor who will support the HCWcf and advocate on their behalf about issues concerning work placement and tasks.
   c. Assigning a supervisor who is knowledgeable about the issues facing the HCWcf, aware of relevant ethical issues, prepared to work collaboratively with the HCWcf and with the treating CF team and local infection prevention and control team.
   d. Appointing a supervisor for a period sufficient to allow consistency of approach for the individual.
   e. Appointing a supervisor to consider specific risk exposures, particularly for those HCWcf in training and those rotating through various clinical settings after graduating, during annual work plan discussions. This is a time when the HCWcf and the supervisor have an opportunity to discuss infection status (e.g. chronic infection with potentially pathogenic organisms to ensure that risks are minimized).
   f. The supervisor should negotiate and agree on an individual work plan that is reviewed at least annually (or more frequently if changes in clinical status of the HCWcf occur).
   g. The supervisor should, with the permission of the HCWcf, consult the treating CF physician and an infectious disease physician (either from the health care facility or attached to the CF unit) about the work plan.
   h. The individual infection control plan should incorporate specifics based on over-arching principles of infection prevention and control (e.g. hand hygiene and cough etiquette) and CF-specific factors (e.g. avoidance of harm to patients, not exposing HCW to undue risk, high-risk situations and approaches to managing cough/airway clearance in the workplace).
   i. The work plan should be flexible so that it can adapt to predictable changes in the work environment (such as clinical rotations) so as not to require unnecessarily frequent changes or reassessments.
   j. Encouraging discussions between the HCWcf and their supervisor that allow the HCWcf to explore areas of clinical practice where they might feel uncomfortable and explore options to opt out of providing care to high-risk patients.

k. Regular assessment of adherence to the agreed work plan by the HCWcf and their supervisor (including any feedback from clinical rotation supervisors).
l. Keeping these discussions separate from performance plan reviews.

CF health care team

It is recommended:

1. That the CF team members be aware of specific infection risks associated with working as a HCWcf (for the individual, other HCW and patients) and proactively discuss these risks with all HCWcf (including those in training or contemplating training for employment opportunities in health care). Issues to be considered include:
   a. The need for a pathogen eradication treatment where this would be considered standard practice and in particular for *P. aeruginosa* and MRSA infection[71,72];
   b. The role of ongoing regular microbiological monitoring;
   c. The need for discussions and support for the establishment of a work plan between the HCWcf and their supervisor (Work planning section 'HCWcf').
   d. That if adolescent patients are considering a career in health care, paediatric CF team members consider discussing with them proven and potential infection risks (e.g. the risk of acquisition of acute respiratory viral infection and MRSA). It is important that such discussions occur in adolescence before vocational and employment training decisions are usually made.
   e. That the infections and immunization status be regularly monitored at routine clinic visits for HCWcf and information be rapidly relayed to the HCWcf when a change in infection status occurs.
   f. That the treating CF physicians keep in regular contact with the HCWcf in order to maintain an open dialogue.
   g. That the treating physicians have an understanding of the law as it affects the HCWcf, especially privacy law.

Hospitals and health care services and infection prevention and control teams

It is recommended:

1. That health care services ensure that there is a specific work plan for all HCWcf that is regularly reviewed (detailed above).
2. That the health care services provide appropriate employment opportunities for the HCWcf.
3. That health care services discuss strategies to minimize the risk of infection for the HCWcf from the working environment, and the risk to patients and other HCW from the HCWcf.
4. That health care services provide a flexible approach to managing the HCWcf during their employment to protect the HCWcf, other HCW and patients.
5. That health care services enact policy to ensure that the HCWcf and their supervisor regularly assess the agreed work plan (including any feedback from clinical rotation supervisors).
6. That health care services have grievance processes that observe the principles of natural justice and are able to be engaged in response to complaints concerning, for example, an HCWcf who fails to adhere to the guidelines, a supervisor who does not support the HCWcf in the context of the employment or placement of an HCW who puts the HCWcf at additional risk.

Universities and clinical schools

It is recommended:

1. That the student HCWcf be allocated a senior mentor at both the university/training organization and the health care service in the year preceding their first clinical placement and continue throughout training.
2. That an annually reviewed personal infection prevention and control plan (as detailed above) be agreed amongst the mentor(s) and the HCWcf to minimize the risk of colonization or infection during clinical placements.
3. That the plan considers issues such as arranging designated non-clinical space/facilities for physiotherapy if required. Consultation with the student's CF physician may be required.
4. That the mentor liaise with individual clinical supervisors (with the permission of the HCWcf) to ensure that restrictions are not put in place that unnecessarily limit training opportunities.
5. That the clinical school liaise with each concerned hospital infection prevention and control team to ensure that the clinical circumstances of each HCWcf is understood by hospital managers and the particular hospital workforce health and/or infection prevention and control policy for the management of HCWcf is understood by the student.
6. That the student with CF be able to engage university grievance processes if the student believes the university has denied them enrolment, or a placement and or terminates a placement without reasonable grounds, or where the university puts the student at unnecessary risk in a placement.

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Disclosure statement

All members of the working group advise no conflict of interest relevant to the content of this position paper.

Abbreviations: CF, cystic fibrosis; HCW, health care worker; HCWcf, HCW with CF; MRSA, methicillin-resistant *Staphylococcus aureus*; NTM, non-tuberculous mycobacteria; PPE, personal protective equipment.

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Supplementary Information

Additional supplementary information can be accessed via the *html* version of this article at the publisher's website.

Appendix S1 Infection control strategies for HCWcf.
Appendix S2 Additional information.